

FCC TEST REPORT
FOR
SHENZHEN SURF ELECTRICAL APPLIANCE CO., LTD.
Bluetooth wooden speaker
Test Model: SF-2023
Additional Model: SP3211WNW-BRA

Prepared for : SHENZHEN SURF ELECTRICAL APPLIANCE CO., LTD.
Address : BUILDING 3, SHUICHAN INDUSTRIAL PARK, GUSHU
COMMUNITY, XIXIANG TOWN, BAO' AN DISTRICT,
SHENZHEN, CHINA

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Date of receipt of test sample : August 25, 2016
Number of tested samples : 1
Sample number : 201609
Date of Test : August 25, 2016 ~ September 20, 2016
Date of Report : September 21, 2016

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247): 2015

Report Reference No. : **LCS1608252231E**

Date of Issue : September 21, 2016

Testing Laboratory Name : **Shenzhen LCS Compliance Testing Laboratory Ltd.**

Address : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure : Full application of Harmonised standards Partial application of Harmonised standards Other standard testing method

Applicant's Name : **SHENZHEN SURF ELECTRICAL APPLIANCE CO., LTD.**

Address : BUILDING 3, SHUICHAN INDUSTRIAL PARK, GUSHU COMMUNITY, XIXIANG TOWN, BAO' AN DISTRICT, SHENZHEN, CHINA

Test Specification

Standard : FCC CFR 47 PART 15 C(15.247): 2015 / ANSI C63.10: 2013

Test Report Form No. : LCSEMC-1.0

TRF Originator : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF : Dated 2011-03

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Test Item Description : **Bluetooth wooden speaker**

Trade Mark : SURF

Test Model : SF-2023

Ratings : 5V=, 1A

Result : **Positive**

Compiled by:



Aking Jin/ File administrators

Supervised by:



Glin Lu/ Technique principal

Approved by:



Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS1608252231E**September 21, 2016

Date of issue

Test Model..... : SF-2023

EUT..... : Bluetooth wooden speaker

Applicant..... : SHENZHEN SURF ELECTRICAL APPLIANCE CO., LTD.Address..... : BUILDING 3, SHUICHAN INDUSTRIAL PARK, GUSHU
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SHENZHEN, CHINA

Telephone..... : /

Fax..... : /

Test Result**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

| Revision | Issue Date | Revisions | Revised By |
|----------|------------|---------------|-------------|
| 00 | 2016-09-21 | Initial Issue | Gavin Liang |
| | | | |
| | | | |

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1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT : Bluetooth wooden speaker
Test Model : SF-2023
Hardware Version : V1.0
Software Version : V1.0
Power Supply : 5V[—], 1A
Frequency Range : 2402.00-2480.00MHz
Channel Spacing : 1MHz
Channel Number : 79 channels
Modulation Type : GFSK, $\pi/4$ -DQPSK, 8-DPSK
Bluetooth Version : V4.1
Antenna Description : PCB Antenna, 0dBi (Max.)

Additional models No.

| | | |
|---------------|--|--|
| SP3211WNW-BRA | | |
|---------------|--|--|

Remark: PCB board, structure and internal of the related model(s) are the same, So no additional models were tested.

1.2 Support equipment List

| Manufacturer | Description | Model | Serial Number | Certificate |
|---|----------------------|---------------------|---------------|-------------|
| SHENZHEN HUIKE ELECTRONIC CO., LTD | SWITCHING ADAPTER | HK15-HASF050 100 | -- | DOC |

1.3 External I/O

| I/O Port Description | Quantity | Cable |
|----------------------|----------|-------|
| DC Power Port | 1 | N/A |
| AUX Input Port | 1 | N/A |

1.4 Description of Test Facility

CNAS Registration Number. is L4595.

FCC Registration Number. is 899208.

Industry Canada Registration Number. is 9642A-1.

VCCI Registration Number. is C-4260 and R-3804.

ESMD Registration Number. is ARCB0108.

UL Registration Number. is 100571-492.

TUV SUD Registration Number. is SCN1081.

TUV RH Registration Number. is UA 50296516-001

1.5 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Cal Date | Due Date |
|--------------------------|----------------|----------------------------------|-------------|-----------------|----------------|----------------|
| EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz – 2.75GHz | June 18,2016 | June 17,2017 |
| Signal analyzer | Agilent | E4448A(External mixers to 40GHz) | US44300469 | 9kHz~40GHz | July 16,2016 | July 15,2017 |
| LISN | MESS Tec | NNB-2/16Z | 99079 | 9KHz-30MHz | June 18,2016 | June 17,2017 |
| LISN (Support Unit) | EMCO | 3819/2NM | 9703-1839 | 9KHz-30MHz | June 18,2016 | June 17,2017 |
| RF Cable-CON | UTIFLEX | 3102-26886-4 | CB049 | 9KHz-30MHz | June 18,2016 | June 17,2017 |
| ISN | SCHAFFNER | ISN ST08 | 21653 | 9KHz-30MHz | June 18,2016 | June 17,2017 |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30M-1GHz 3m | June 18,2016 | June 17,2017 |
| Amplifier | SCHAFFNER | COA9231A | 18667 | 9kHz-2GHz | April 18, 2016 | April 17, 2017 |
| Amplifier | Agilent | 8449B | 3008A02120 | 1GHz-26.5GHz | April 18, 2016 | April 17, 2017 |
| Amplifier | MITEQ | AMF-6F-260400 | 9121372 | 26.5GHz-40GHz | April 18, 2016 | April 17, 2017 |
| Spectrum Analyzer | Agilent | E4407B | MY41440292 | 9k-26.5GHz | July 16,2016 | July 15,2017 |
| MAX Signal Analyzer | Agilent | N9020A | MY50510140 | 20Hz~26.5GHz | Oct. 27,2015 | Oct. 26,2016 |
| Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9k-30MHz | April 18, 2016 | April 17, 2017 |
| By-log Antenna | SCHWARZBECK | VULB9163 | 9163-470 | 30MHz-1GHz | April 18, 2016 | April 17, 2017 |
| Horn Antenna | EMCO | 3115 | 6741 | 1GHz-18GHz | April 18, 2016 | April 17, 2017 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170154 | 15GHz-40GHz | April 18, 2016 | April 17, 2017 |
| RF Cable-R03m | Jye Bao | RG142 | CB021 | 30MHz-1GHz | June 18,2016 | June 17,2017 |
| RF Cable-HIGH | SUHNER | SUCOFLEX 106 | 03CH03-HY | 1GHz-40GHz | June 18,2016 | June 17,2017 |
| Power Meter | R&S | NRVS | 100444 | DC-40GHz | June 18,2016 | June 17,2017 |
| Power Sensor | R&S | NRV-Z51 | 100458 | DC-30GHz | June 18,2016 | June 17,2017 |
| Power Sensor | R&S | NRV-Z32 | 10057 | 30MHz-6GHz | June 18,2016 | June 17,2017 |
| RF CABLE-1m | JYE Bao | RG142 | CB034-1m | 20MHz-7GHz | June 18,2016 | June 17,2017 |
| RF CABLE-2m | JYE Bao | RG142 | CB035-2m | 20MHz-1GHz | June 18,2016 | June 17,2017 |

Note: All equipment through GRGT EST calibration

1.6 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.7 Measurement Uncertainty

| Test Item | Frequency Range | Uncertainty | Note |
|------------------------|-----------------|-------------|------|
| Radiation Uncertainty | 9KHz~30MHz | 3.10dB | (1) |
| | 30MHz~200MHz | 2.96dB | (1) |
| | 200MHz~1000MHz | 3.10dB | (1) |
| | 1GHz~26.5GHz | 3.80dB | (1) |
| | 26.5GHz~40GHz | 3.90dB | (1) |
| Conduction Uncertainty | 150kHz~30MHz | 1.63dB | (1) |
| Power disturbance | 30MHz~300MHz | 1.60dB | (1) |

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.8 Description of Test Modes

Bluetooth operates in the unlicensed ISM Band at 2.4GHz. With the introduction of the enhanced data rate (EDR) feature, the data rates can be up to 3 Mb/s. An increase in the peak data rate beyond the basic rate of 1 Mb/s is achieved by modulating the RF carrier using GFSK techniques, resulting in an increase of two to three times the number of bits per symbol. The 2 Mb/s EDR packets use a $\pi/4$ -DQPSK modulation, and the 3 Mb/s EDR packets use a 8-DPSK modulation. The following operating modes were applied for the related test items. For radiated measurement, the test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position. All test modes were tested, only the result of the worst case was recorded in the report.

| Mode of Operations | Frequency Range (MHz) | Data Rate (Mbps) |
|------------------------|-----------------------|------------------|
| GFSK | 2402 | 1 |
| | 2441 | 1 |
| | 2480 | 1 |
| $\pi/4$ DQPSK | 2402 | 2 |
| | 2441 | 2 |
| | 2480 | 2 |
| 8-DPSK | 2402 | 3 |
| | 2441 | 3 |
| | 2480 | 3 |
| For Conducted Emission | | |
| Test Mode | TX Mode | |
| For Radiated Emission | | |
| Test Mode | TX Mode | |

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be TX (1Mbps-Hopping Mode).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was determined to be TX-Low Channel (2402MHz, 1Mbps).

***Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

For pre-testing, when performed with LiPo Battery Charger, the input Voltage/Frequency AC 120V/60Hz and AC 240V/60Hz were used. Only recorded the worst case in this report.

Channel List & Frequency

| Frequency Band | Channel No. | Frequency(MHz) | Channel No. | Frequency(MHz) |
|----------------|-------------|----------------|-------------|----------------|
| 2402~2480MHz | 1 | 2402 | 40 | 2441 |
| | 2 | 2403 | -- | -- |
| | 3 | 2404 | -- | -- |
| | -- | -- | 77 | 2478 |
| | -- | -- | 78 | 2479 |
| | 39 | 2440 | 79 | 2480 |

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

2.3 General Test Procedures

2.3.1 Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10: 2013, AC power-line conducted emissions shall be measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table and the turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10: 2013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmit condition.

3.2 EUT Exercise Software

N/A.

3.3 Special Accessories

N/A.

3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

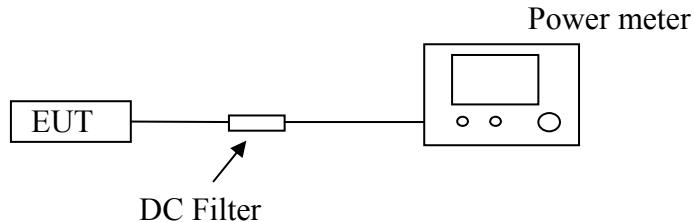
4. SUMMARY OF TEST RESULTS

| Applied Standard: FCC Part 15 Subpart C | | |
|---|---|-----------|
| FCC Rules | Description of Test | Result |
| §15.247(b)(1) | Maximum Conducted Output Power | Compliant |
| §15.247(a)(1) | Frequency Separation And 20 dB Bandwidth | Compliant |
| §15.247(a)(1)(iii) | Number Of Hopping Frequency | Compliant |
| §15.247(a)(1)(iii) | Time Of Occupancy (Dwell Time) | Compliant |
| §15.209, §15.247(d) | Radiated and Conducted Spurious Emissions | Compliant |
| §15.205 | Emissions at Restricted Band | Compliant |
| §15.207(a) | Line Conducted Emissions | Compliant |
| §15.203 | Antenna Requirements | Compliant |

5. ANTENNA PORT MEASUREMENT

5.1 Maximum Conducted Output Power

5.1.1 Block Diagram of Test Setup



5.1.2 Limit

According to § 15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

5.1.3 Test Procedure

The transmitter output is connected to the Power Meter.

5.1.4 Test Results

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 15, 2016 |

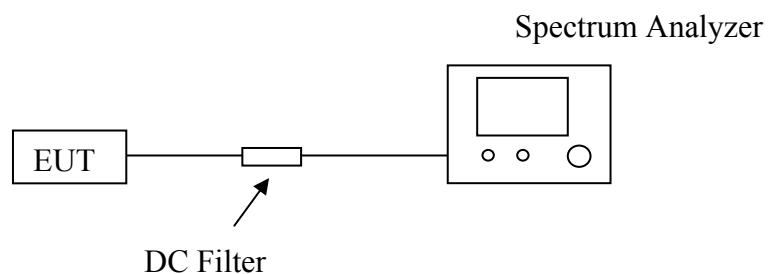
| Channel | Frequency (MHz) | Output Power (dBm, Peak) | Output Power (mW) | Limit (mW) | Result |
|------------------|-----------------|--------------------------|-------------------|------------|--------|
| GFSK | 2402 | -0.563 | 0.878 | 1000 | Pass |
| | 2441 | -0.526 | 0.886 | 1000 | Pass |
| | 2480 | -0.333 | 0.926 | 1000 | Pass |
| $\pi/4$ DQPSK | 2402 | -0.426 | 0.907 | 125 | Pass |
| | 2441 | -0.625 | 0.866 | 125 | Pass |
| | 2480 | -0.625 | 0.866 | 125 | Pass |
| 8-DPSK | 2402 | -0.569 | 0.877 | 125 | Pass |
| | 2441 | -0.741 | 0.843 | 125 | Pass |
| | 2480 | -0.626 | 0.866 | 125 | Pass |

5.2 Frequency Separation and 20 dB Bandwidth

5.2.1 Limit

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.2.2 Block Diagram of Test Setup



5.2.3 Test Procedure

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set to the maximum power setting and enable the EUT transmit continuously.
- D. For carrier frequency separation measurement, use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels;
RBW / VBW=100 KHz/ 300KHz; Sweep = auto; Detector function = peak;
Trace = max hold.
- E. For 20dB bandwidth measurement, use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW/VBW=30 KHz/ 100KHz; Sweep = auto; Detector function = peak;
Trace = max hold.

5.2.4 Test Results

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

| The Measurement Result With 1Mbps For GFSK Modulation | | | |
|---|--------------------------|---------------|--------|
| 20dB Bandwidth Measurement | | | |
| Channel | 20dB Bandwidth (MHz) | Limit | |
| Low | 0.771 | Non-specified | |
| Middle | 0.776 | Non-specified | |
| High | 0.777 | Non-specified | |
| Channel Separation Measurement | | | |
| Channel | Channel Separation (MHz) | Limit (MHz) | Result |
| Low | 1.000 | 0.771 | Pass |
| Middle | 1.000 | 0.776 | Pass |
| High | 1.000 | 0.777 | Pass |

| The Measurement Result With 2Mbps For $\pi/4$ DQPSK Modulation | | | |
|--|--------------------------|---------------|--------|
| 20dB Bandwidth Measurement | | | |
| Channel | 20dB Bandwidth (MHz) | Limit | |
| Low | 1.274 | Non-specified | |
| Middle | 1.277 | Non-specified | |
| High | 1.269 | Non-specified | |
| Channel Separation Measurement | | | |
| Channel | Channel Separation (MHz) | Limit (MHz) | Result |
| Low | 1.000 | 0.849 | Pass |
| Middle | 1.000 | 0.851 | Pass |
| High | 1.000 | 0.846 | Pass |

| The Measurement Result With 3Mbps For 8-DPSK Modulation | | | |
|---|--------------------------|---------------|--------|
| 20dB Bandwidth Measurement | | | |
| Channel | 20dB Bandwidth (MHz) | Limit | |
| Low | 1.241 | Non-specified | |
| Middle | 1.241 | Non-specified | |
| High | 1.245 | Non-specified | |
| Channel Separation Measurement | | | |
| Channel | Channel Separation (MHz) | Limit (MHz) | Result |
| Low | 1.000 | 0.827 | Pass |
| Middle | 1.000 | 0.827 | Pass |
| High | 1.000 | 0.830 | Pass |

The test data refer to the following page.

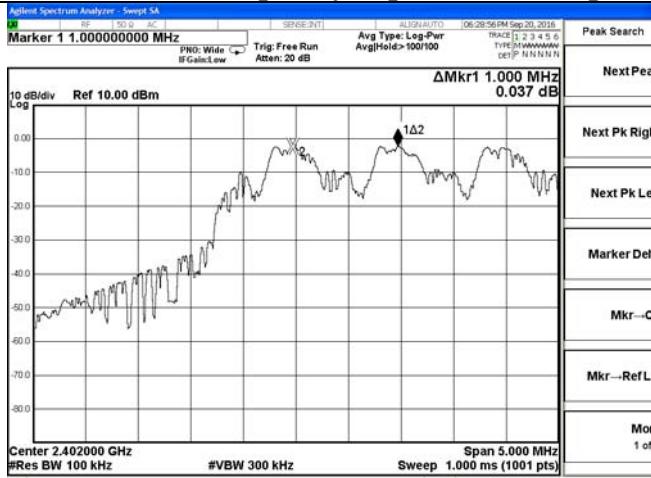
For Frequency Separation Measurement, the Low, Mid and High channels were performed and only recorded the worst test plots for Low in this report.

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

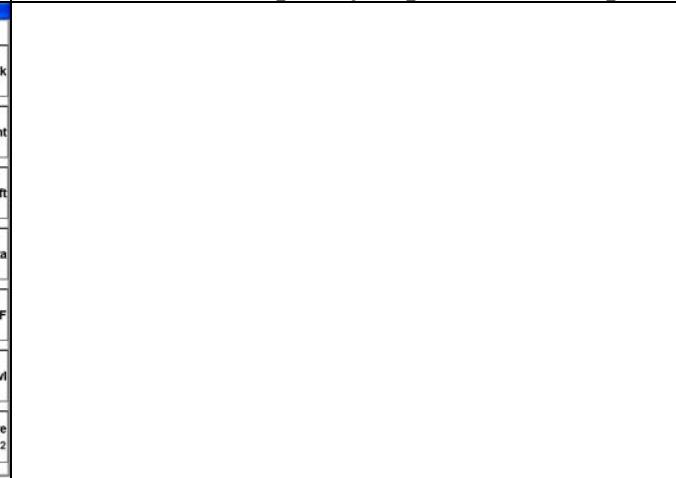
Test Plot Of Frequency Separation



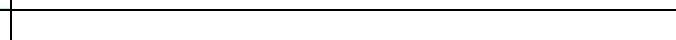
Test Plot Of Frequency Separation (1Mbps)



Test Plot Of Frequency Separation (2Mbps)

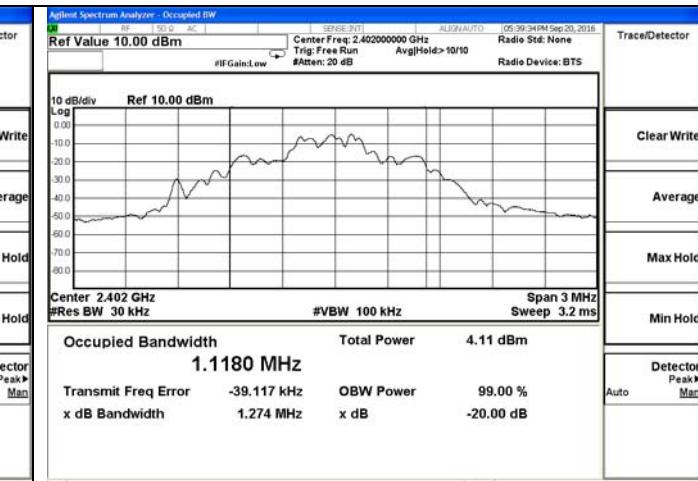
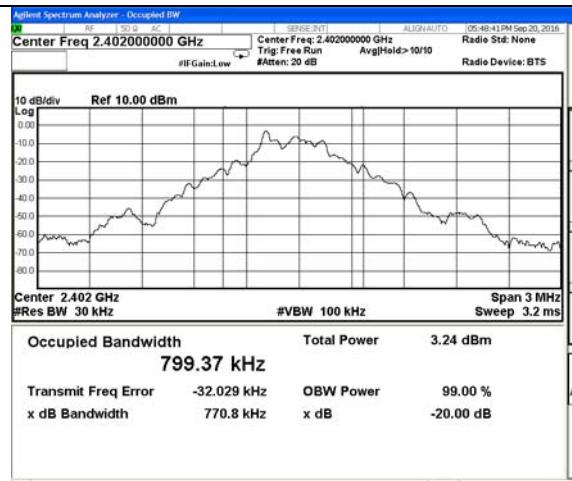


Test Plot Of Frequency Separation (3Mbps)

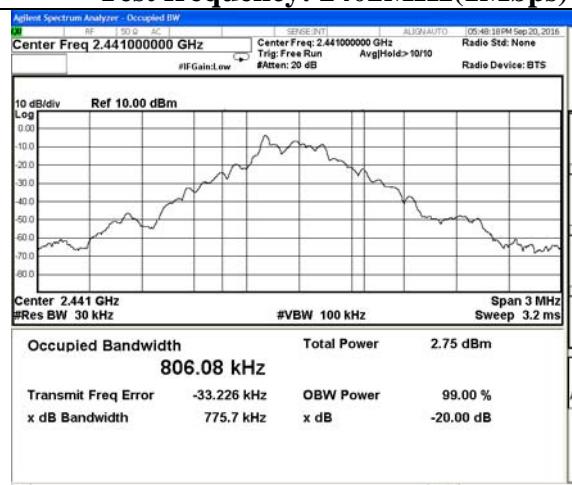


| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

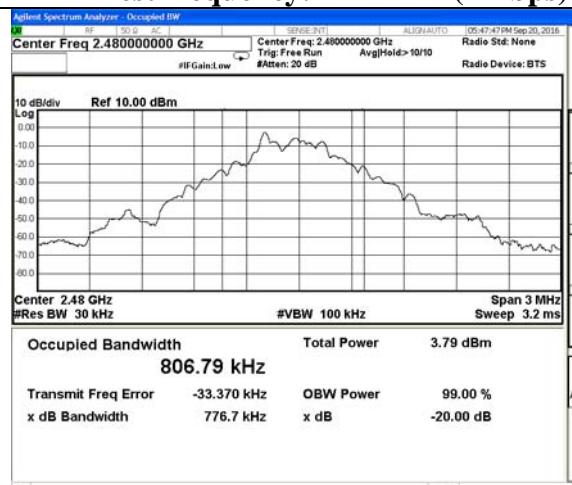
Measurement of 20dB Bandwidth



Test frequency: 2402MHz(1Mbps)

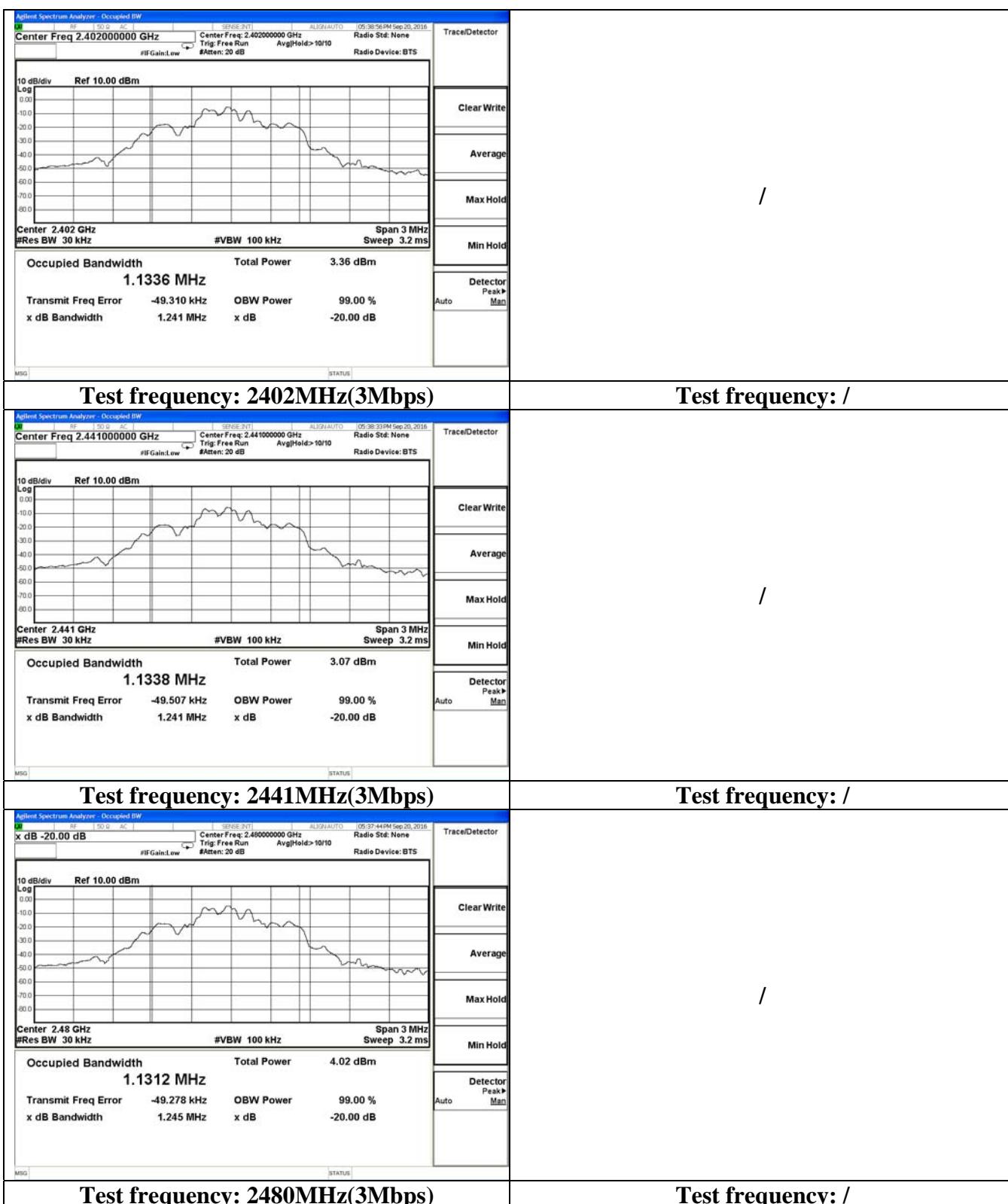


Test frequency: 2441MHz(1Mbps)



Test frequency: 2480MHz(1Mbps)

Test frequency: 2480MHz(2Mbps)

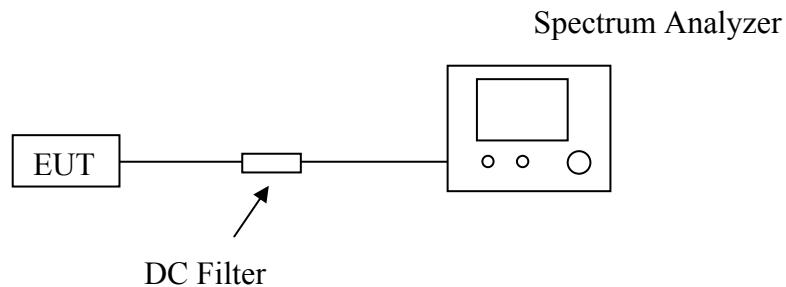


5.3 Number of Hopping Frequency

5.3.1 Limit

According to §15.247(a)(1)(iii), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.3.2 Block Diagram of Test Setup



5.3.3 Test Procedure

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set Spectrum Analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- D. Set the Spectrum Analyzer as RBW, VBW=1MHz.
- E. Max hold, view and count how many channel in the band.

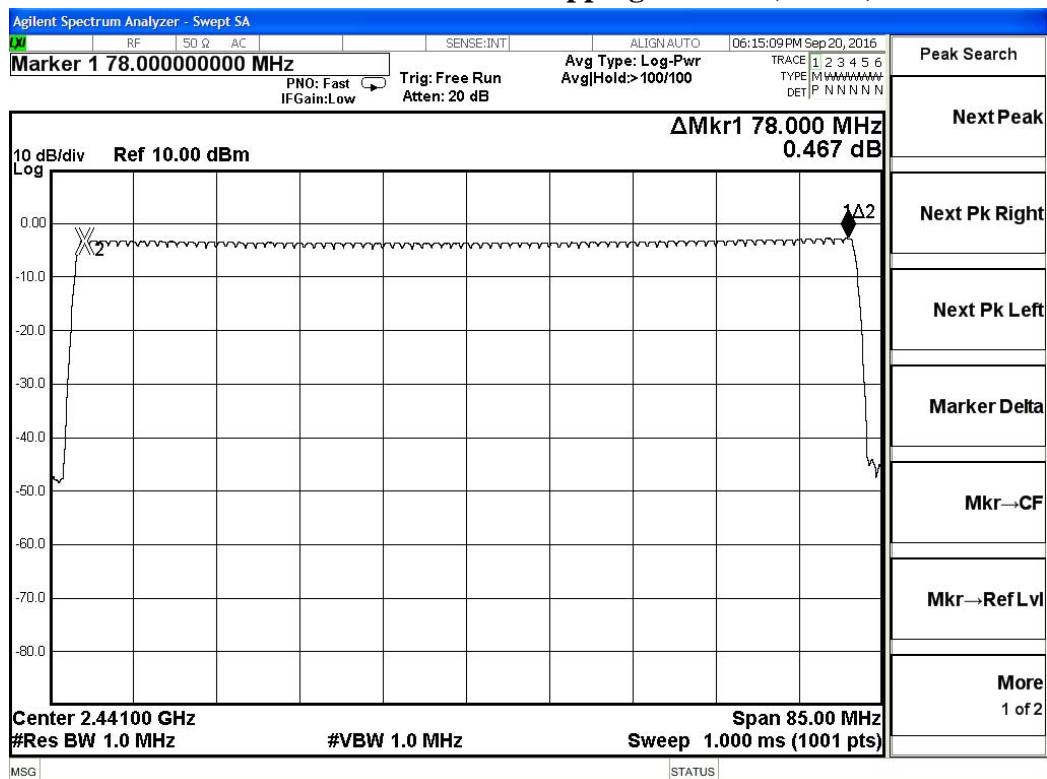
5.3.4 Test Results

| Test Mode | Measurement Result (No. of Ch) | Limit (No. of Ch) | Result |
|----------------------|-----------------------------------|----------------------|--------|
| Hopping(GFSK) | 79 | ≥15 | Pass |
| Hopping(π /4-DQPSK) | 79 | ≥15 | Pass |
| Hopping(8-DPSK) | 79 | ≥15 | Pass |

The worst test data refer to the following page.

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

Test Plot For Number of Hopping Channel(GFSK)

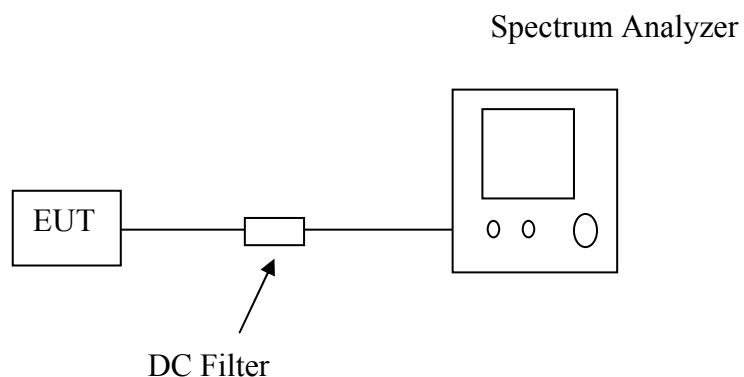


5.4 Time of Occupancy (Dwell Time)

5.4.1 Limit

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4seconds multiplied by the number of hopping channels employed.

5.4.2 Block Diagram of Test Setup



5.4.3 Test Procedure

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set center frequency of Spectrum Analyzer = operating frequency.
- D. Set the Spectrum Analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
- E. Repeat above procedures until all frequency measured were complete.

5.4.4 Test Results

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

| The Measurement Result | | | | |
|------------------------|--------------------|-----------------|-----------------|------------|
| Test Mode | Time of Pulse (ms) | Period Time (s) | Sweep Time (ms) | Limit (ms) |
| DH1-2441MHz | 0.376 | 31.6 | 120.3 | 400 |
| DH3-2441MHz | 1.632 | 31.6 | 261.1 | 400 |
| DH5-2441MHz | 2.880 | 31.6 | 307.2 | 400 |
| 2DH1-2441MHz | 0.388 | 31.6 | 124.2 | 400 |
| 2DH3-2441MHz | 1.640 | 31.6 | 262.4 | 400 |
| 2DH5-2441MHz | 2.892 | 31.6 | 308.5 | 400 |
| 3DH1-2441MHz | 0.388 | 31.6 | 124.2 | 400 |
| 3DH3-2441MHz | 1.632 | 31.6 | 261.1 | 400 |
| 3DH5-2441MHz | 2.880 | 31.6 | 307.2 | 400 |

Calculation formula:

DH1/2DH1/3DH1

Dwell Time =Burst Length (ms)*(1600/2)/79*31.6

DH3/2DH3/3DH3

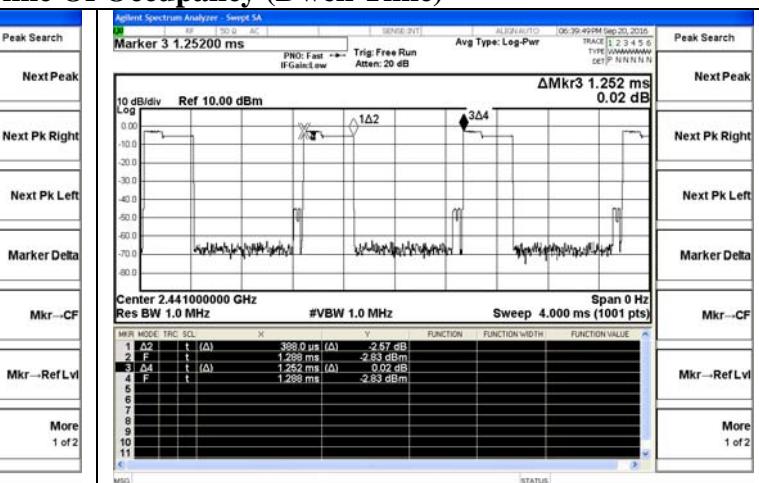
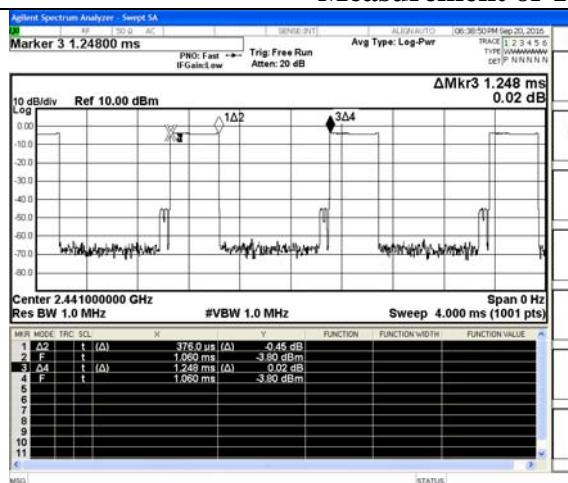
Dwell Time =Burst Length (ms)*(1600/4)/79*31.6

DH5/2DH5/3DH5

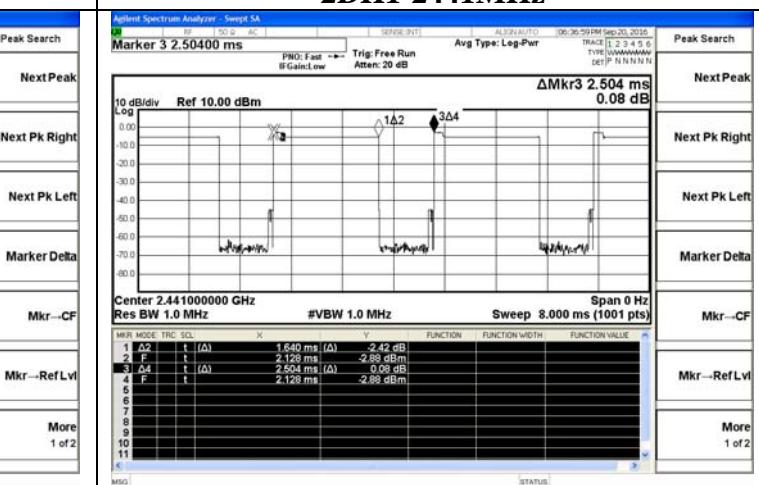
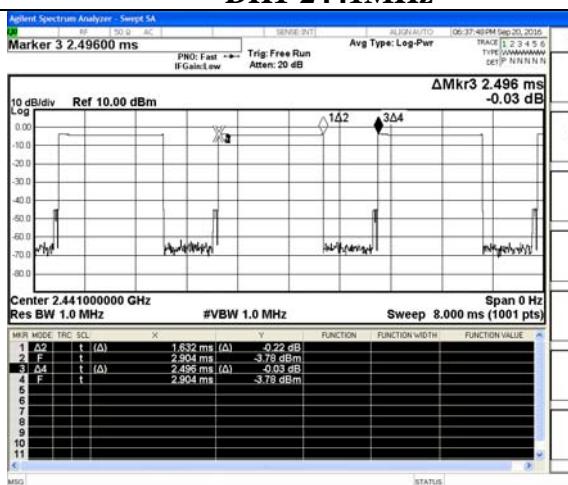
Dwell Time =Burst Length (ms)*(1600/6)/79*31.6

The test data refer to the following page:

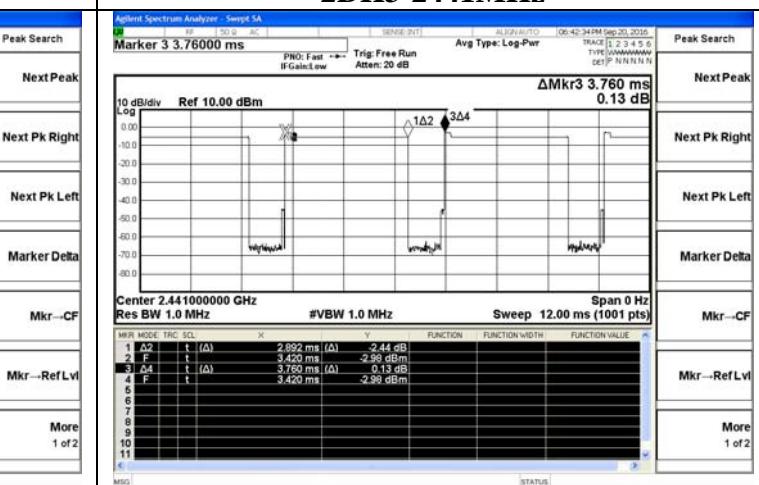
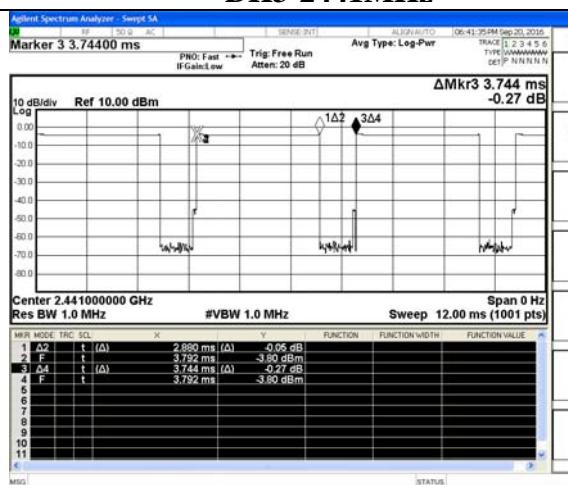
Measurement of Time Of Occupancy (Dwell Time)



DH1-2441MHz

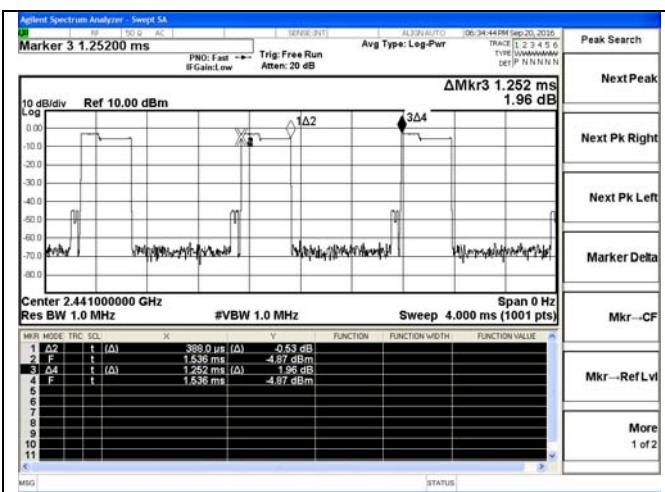


DH3-2441MHz

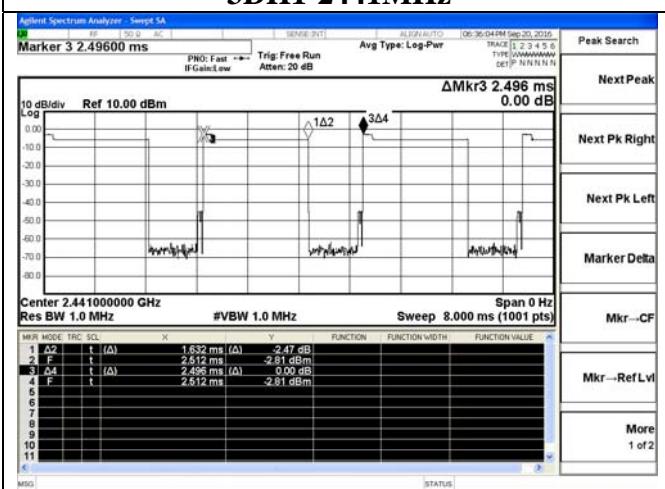


DH5-2441MHz

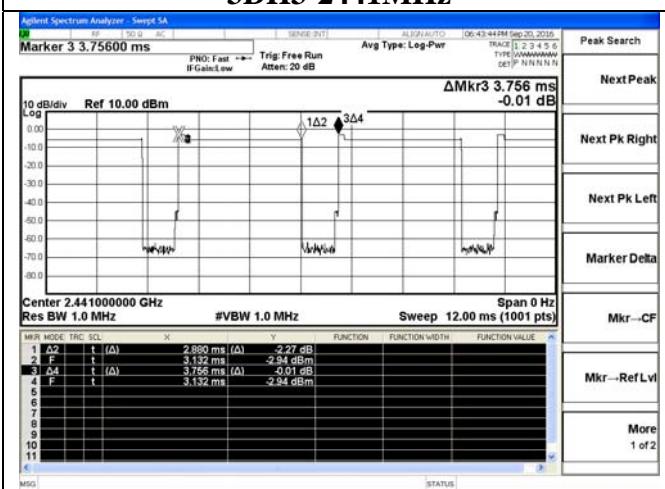
2DH1-2441MHz



3DH1-2441MHz



3DH3-2441MHz



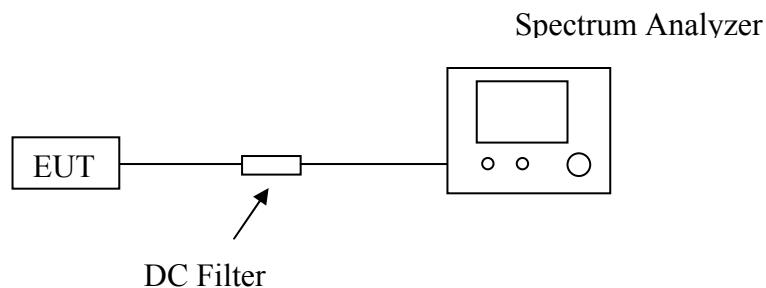
3DH5-2441MHz

5.5 Conducted Spurious Emissions and Band Edges Test

5.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.5.2 Block Diagram of Test Setup



5.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

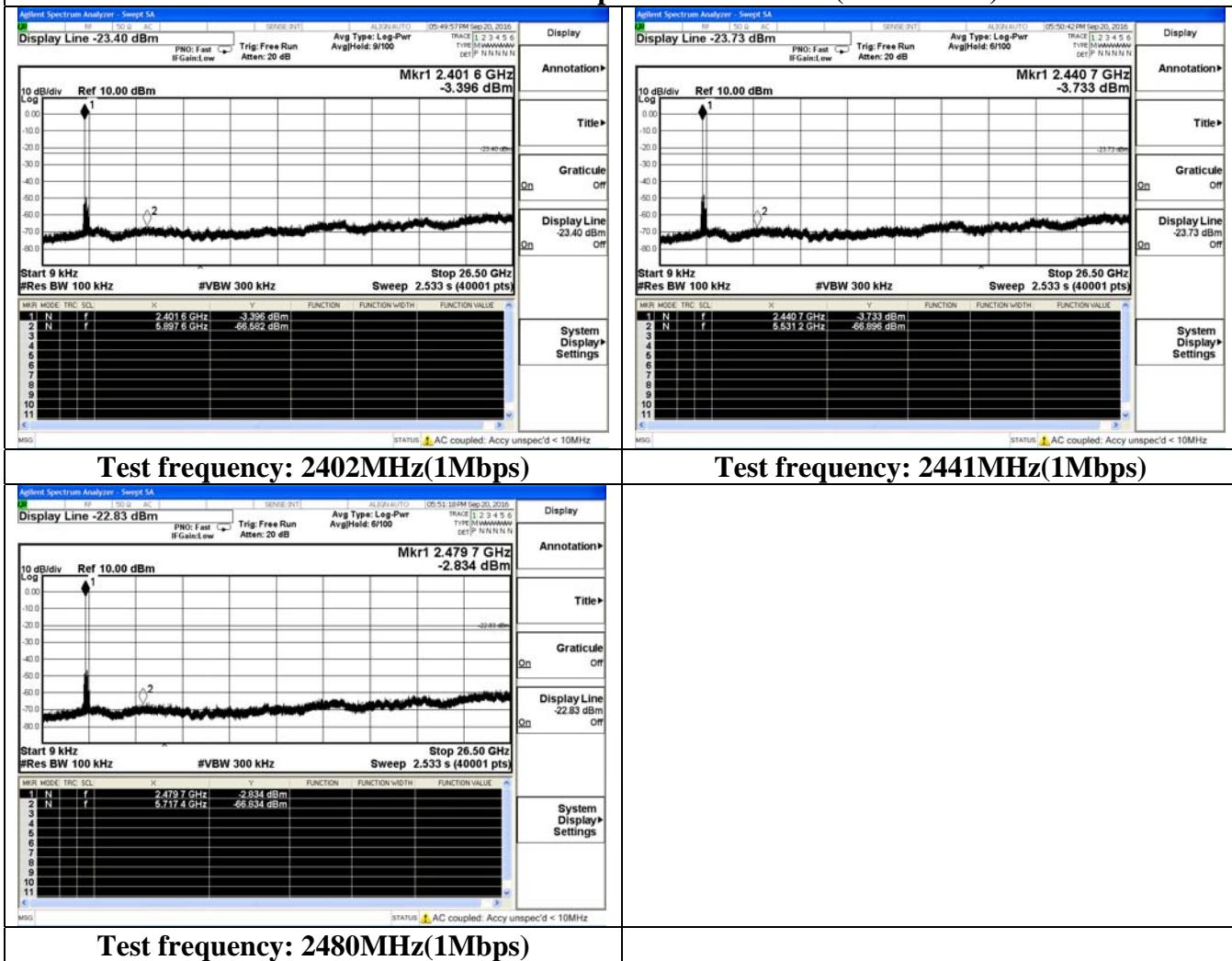
Measurements are made over the 9 kHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels

5.5.4 Test Results of Conducted Spurious Emissions

No non-compliance noted. Only record the worst test result (TX-GFSK) in this report. The test data refer to the following page.

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |

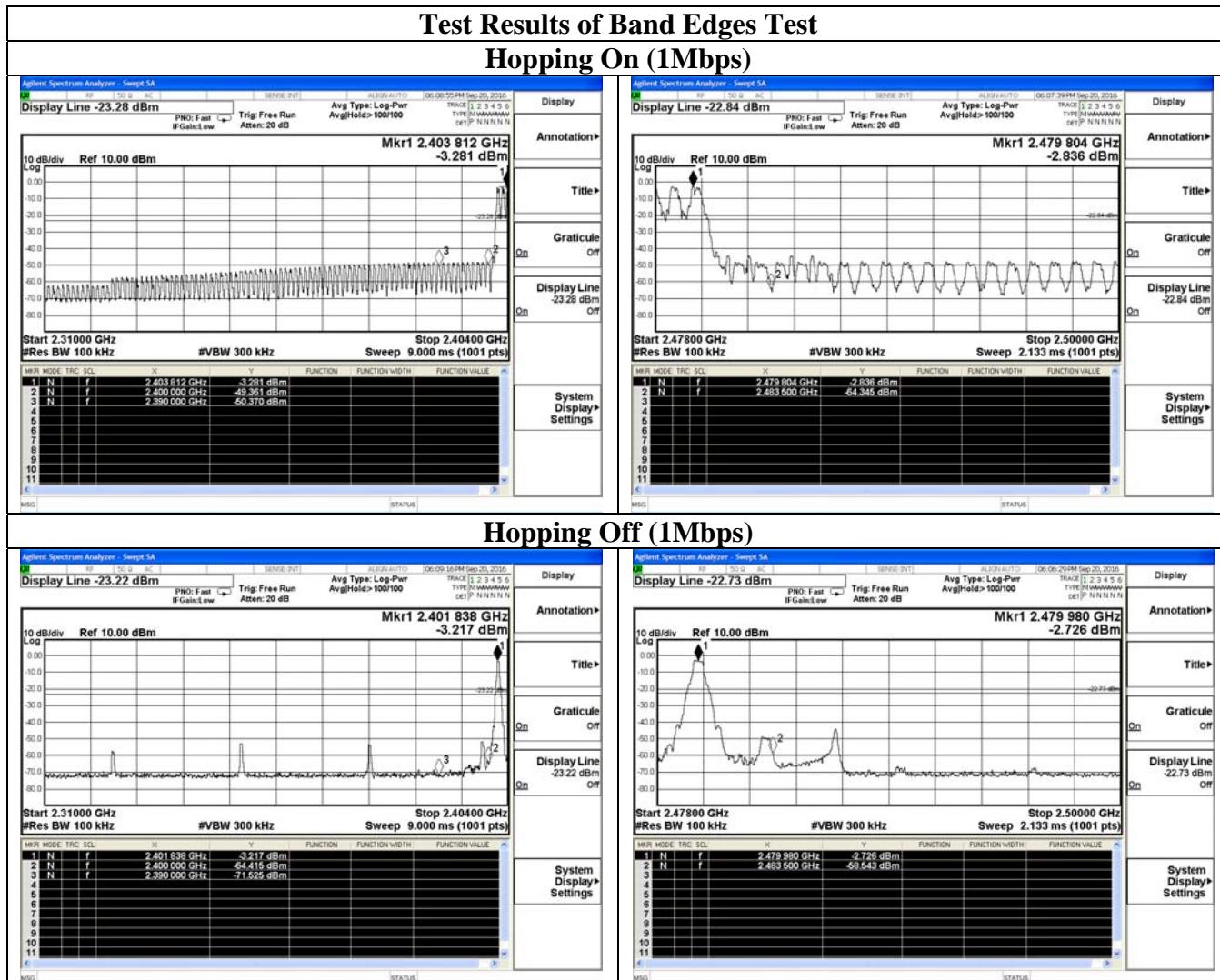
Test Results of Conducted Spurious Emissions (Worst Case)



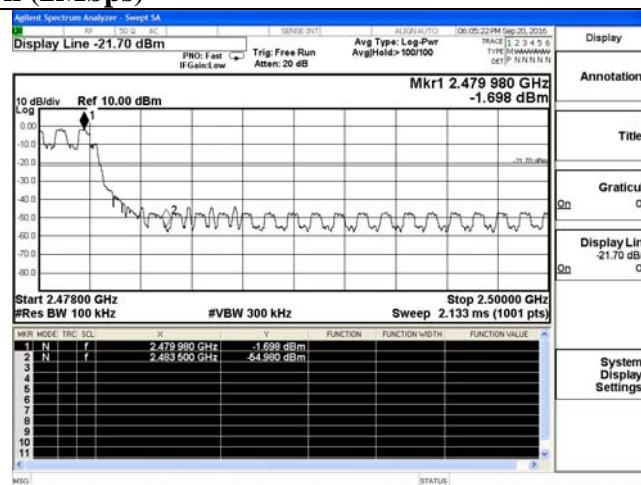
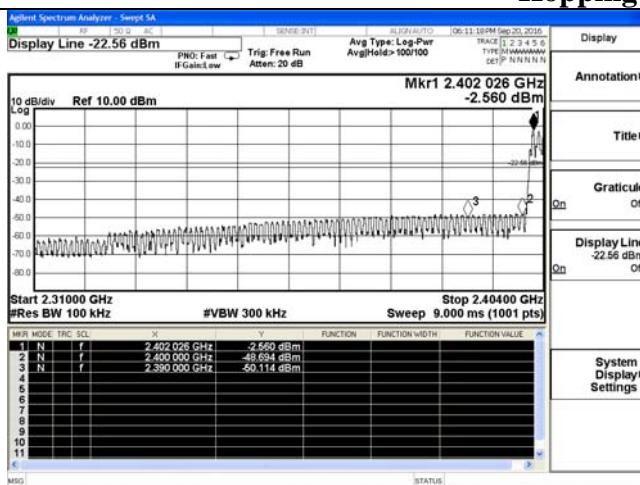
5.5.5 Test Results of Band Edges Test

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

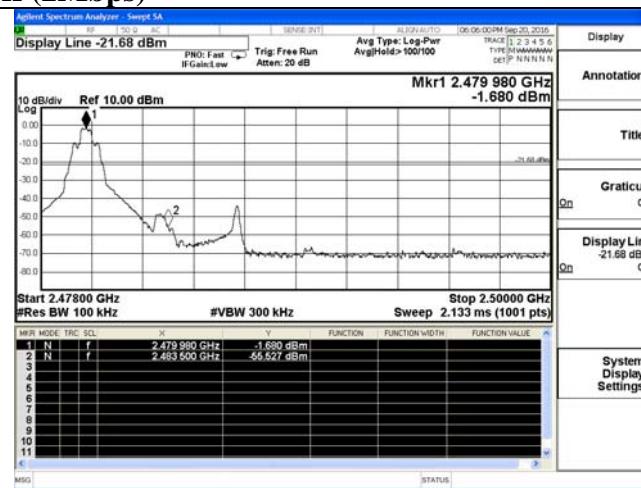
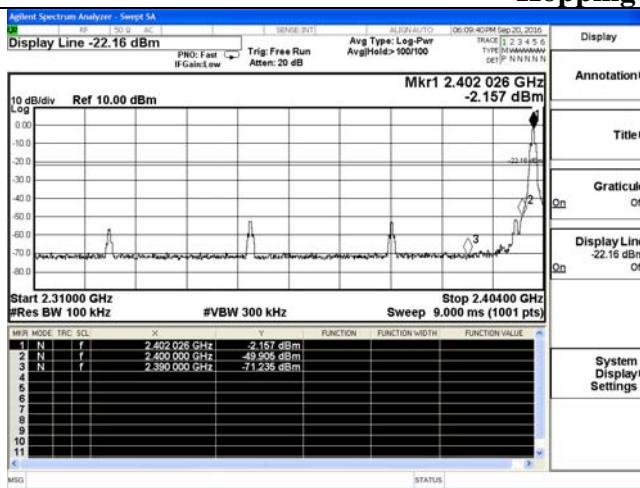
| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 20, 2016 |



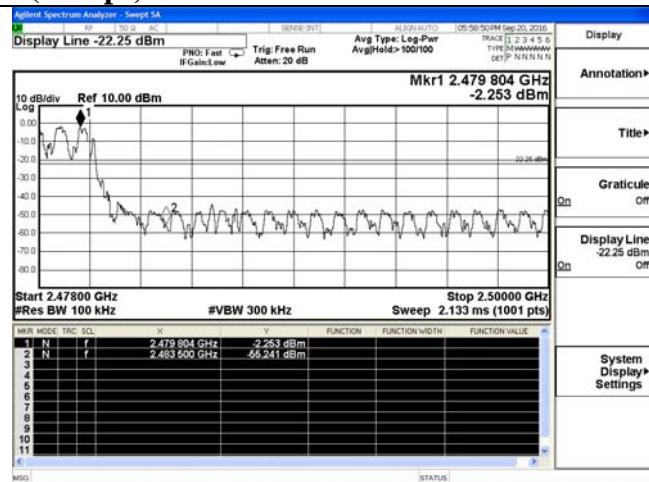
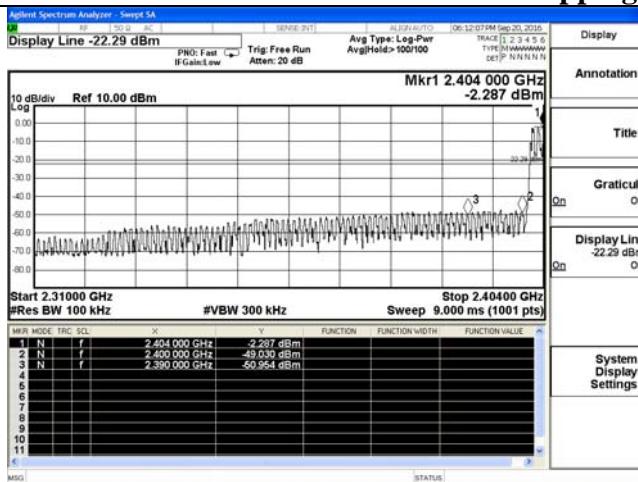
Hopping On (2Mbps)



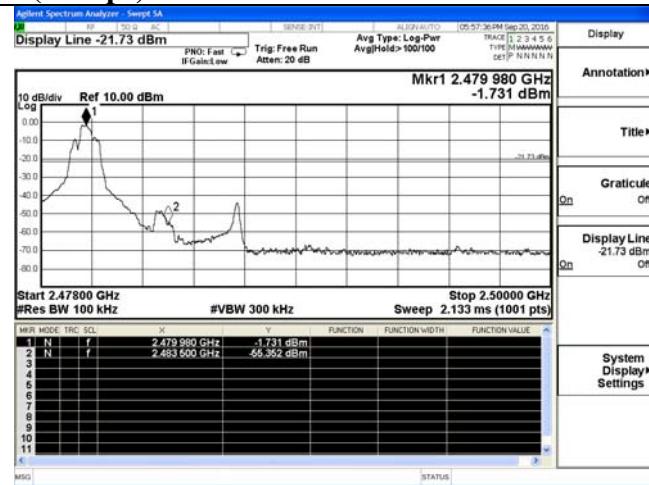
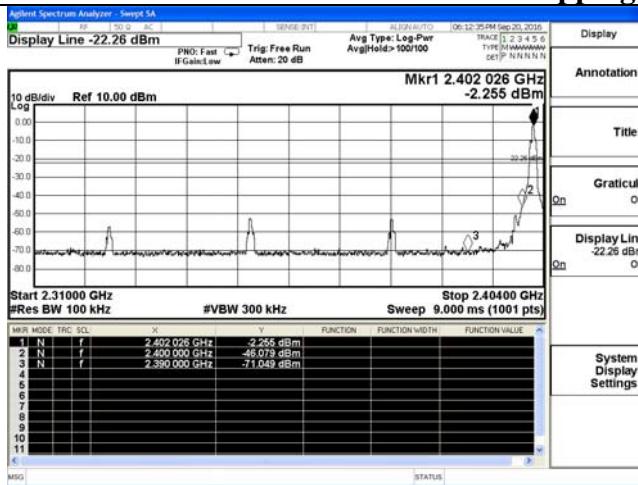
Hopping Off (2Mbps)



Hopping On (3Mbps)



Hopping Off (3Mbps)



6. RADIATED MEASUREMENT

6.1 Standard Applicable

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies(MHz) | Field Strength(microvolts/meter) | Measurement Distance(meters) |
|------------------|----------------------------------|------------------------------|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

6.2 Instruments Setting

The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|--|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (Emission in restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter | Setting |
|------------------------|----------------------------------|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 100kHz for QP |

6.3 Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8mm height is used.
- If the EUT is a floor-standing and typically installed with its base in direct electrical contact with, or connected to, a grounded metal floor or grid, the EUT shall be connected to, or placed directly on, the test site (or turntable) reference ground plane in a manner representative of this contact or connection.
- If the EUT is a floor-standing and not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid, the EUT shall not be placed in direct electrical contact with the test site (or turntable) reference ground plane. If necessary to prevent direct metallic contact of the EUT and the reference ground plane, insulating material (up to 12 mm thick) shall be placed under the EUT.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premereasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 0.8 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8m height is used, which is placed on the ground plane.
- If the EUT is a floor-standing and typically installed with its base in direct electrical contact with, or connected to, a grounded metal floor or grid, the EUT shall be connected to, or placed directly on, the test site (or turntable) reference ground plane in a manner representative of this contact or connection.
- If the EUT is a floor-standing and not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid, the EUT shall not be placed in direct electrical contact with the test site (or turntable) reference ground plane. If necessary to prevent direct metallic contact of the EUT and the reference ground plane, insulating material (up to 12 mm thick) shall be placed under the EUT.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor-standing and typically installed with its base in direct electrical contact with, or connected to, a grounded metal floor or grid, the EUT shall be connected to, or placed directly on, the test site (or turntable) reference ground plane in a manner representative of this contact or connection.
- If the EUT is a floor-standing and not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid, the EUT shall not be placed in direct electrical contact with the test site (or turntable) reference ground plane. If necessary to prevent direct metallic contact of the EUT and the reference ground plane, insulating material (up to 12 mm thick) shall be placed under the EUT.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premereasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor-standing and typically installed with its base in direct electrical contact with, or connected to, a grounded metal floor or grid, the EUT shall be connected to, or placed directly on, the test site (or turntable) reference ground plane in a manner representative of this contact or connection.
- If the EUT is a floor-standing and not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid, the EUT shall not be placed in direct electrical contact with the test site (or turntable) reference ground plane. If necessary to prevent direct metallic contact of the EUT and the reference ground plane, insulating material (up to 12 mm thick) shall be placed under the EUT.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

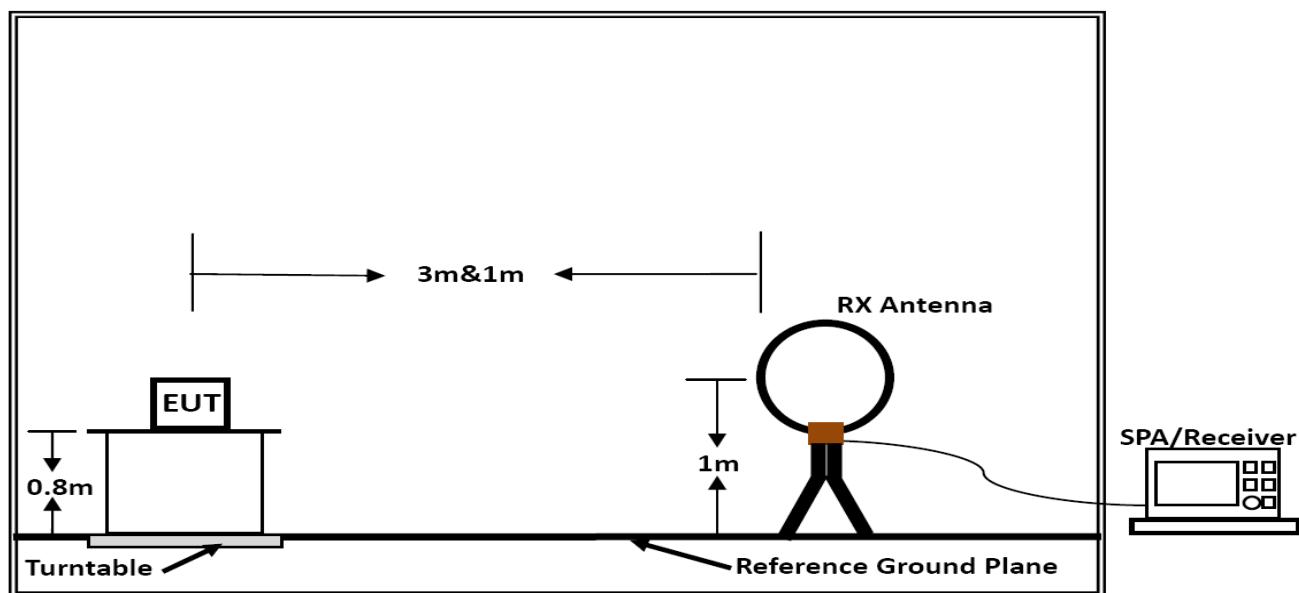
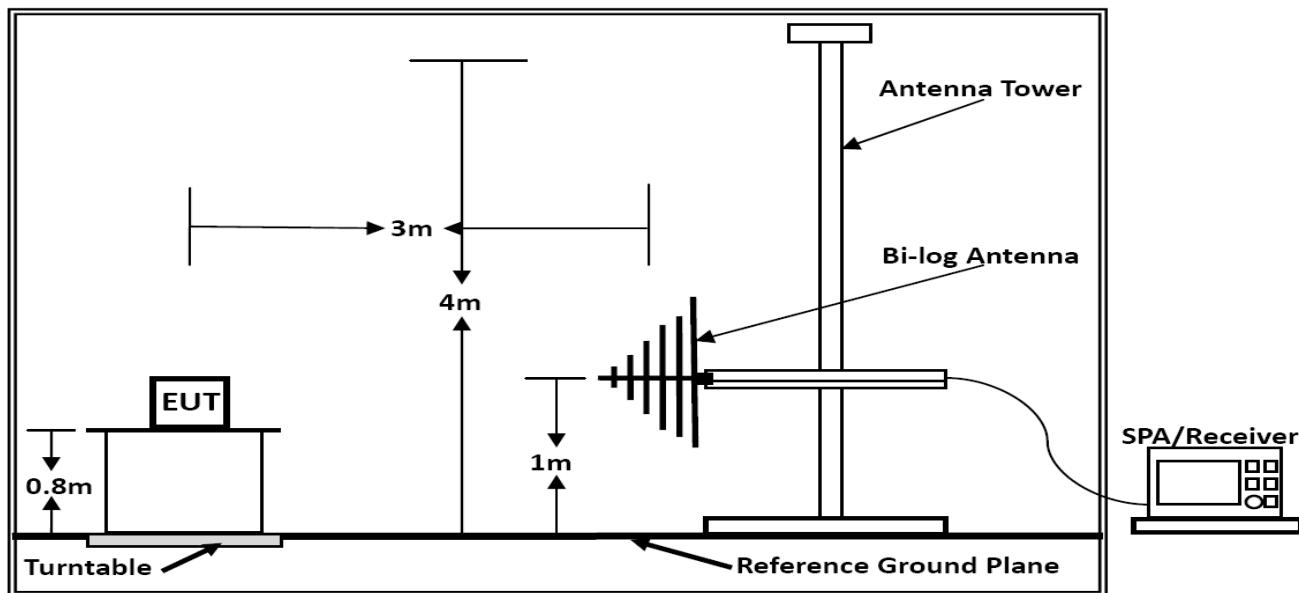
Premeasurement:

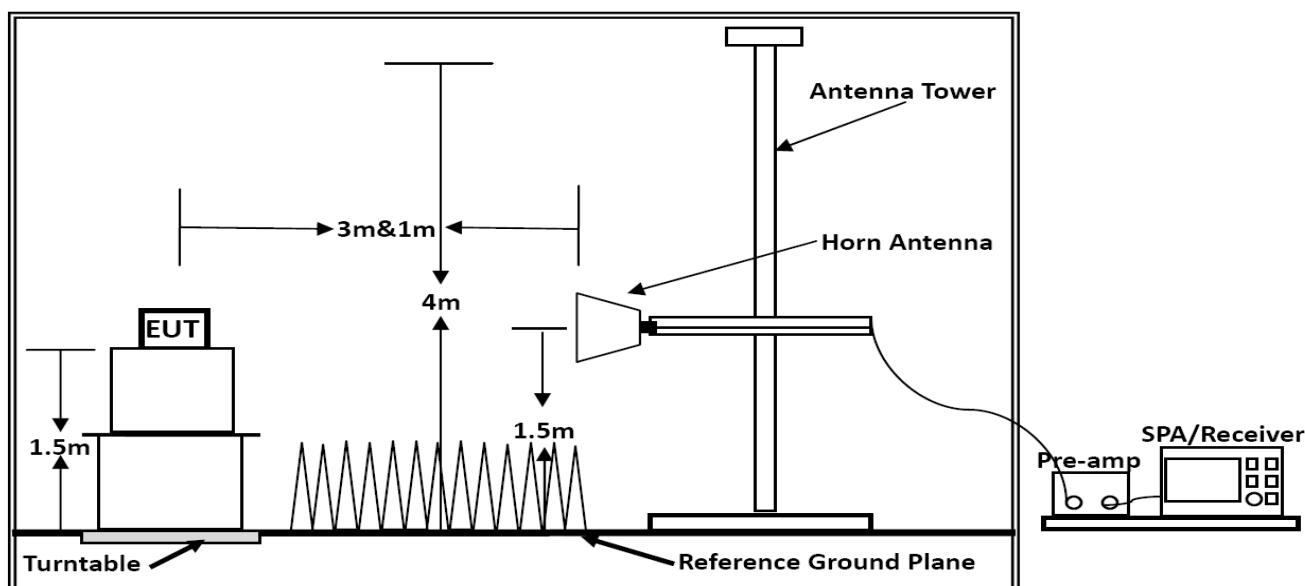
- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

6.4 Test Setup Layout

**Below 30MHz****Below 1GHz**



Above 1GHz

6.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6 Results for Radiated Emissions

PASS.

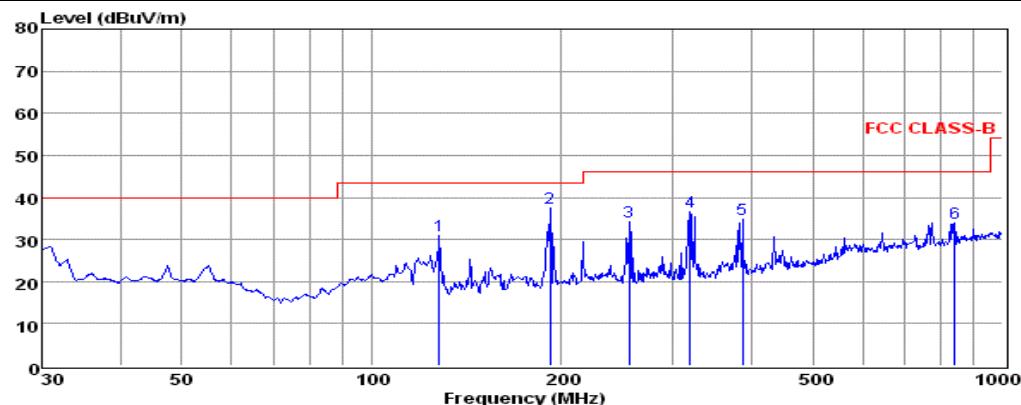
Only record the worst test result in this report.

The radiated emissions from 9 kHz to 30MHz are at least 20dB below the official limit and no need to report.

The test data please refer to following page:

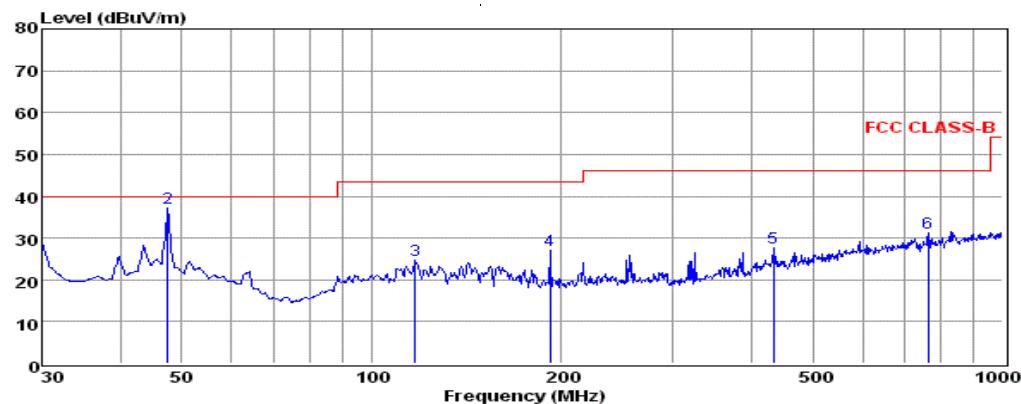
Below 1GHz

| | | | |
|-----------------------|----------|----------------|-----------------------|
| Temperature/ Humidity | 24°C/56% | Configurations | TX-Low Channel(1Mbps) |
| Test Engineer | Jayden | Test Date | September 18, 2016 |



| Freq | Reading | CabLos | Antfac | Measured | | Limit | Over | Remark |
|------|---------|--------|--------|----------|-------|-------|--------|--------|
| | | | | MHz | dBuV | dB | dB/m | dBuV/m |
| 1 | 128.11 | 20.94 | 0.67 | 9.22 | 30.83 | 43.50 | -12.67 | QP |
| 2 | 191.75 | 25.96 | 0.86 | 10.56 | 37.38 | 43.50 | -6.12 | QP |
| 3 | 255.62 | 21.15 | 1.02 | 12.06 | 34.23 | 46.00 | -11.77 | QP |
| 4 | 319.94 | 21.96 | 1.16 | 13.33 | 36.45 | 46.00 | -9.55 | QP |
| 5 | 386.63 | 18.61 | 1.32 | 14.75 | 34.68 | 46.00 | -11.32 | QP |
| 6 | 839.18 | 11.85 | 1.70 | 20.46 | 34.01 | 46.00 | -11.99 | QP |

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported



| Freq | Reading | CabLos | Antfac | Measured | | Limit | Over | Remark |
|------|---------|--------|--------|----------|-------|-------|--------|--------|
| | | | | MHz | dBuV | dB | dB/m | dBuV/m |
| 1 | 30.00 | 15.98 | 0.39 | 12.33 | 28.70 | 40.00 | -11.30 | QP |
| 2 | 47.49 | 23.32 | 0.35 | 13.40 | 37.07 | 40.00 | -2.93 | QP |
| 3 | 117.36 | 13.14 | 0.68 | 10.95 | 24.77 | 43.50 | -18.73 | QP |
| 4 | 191.75 | 15.72 | 0.86 | 10.56 | 27.14 | 43.50 | -16.36 | QP |
| 5 | 434.07 | 10.80 | 1.18 | 15.53 | 27.51 | 46.00 | -18.49 | QP |
| 6 | 763.38 | 9.99 | 1.60 | 19.60 | 31.19 | 46.00 | -14.81 | QP |

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported

***Note:

Pre-scan all mode and recorded the worst case results in this report (TX-Low Channel (1Mbps)).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Above 1GHz

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 18, 2016 |

The worst test result for GFSK, Tx-Low Channel:

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark | Pol. |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4804.19 | 44.42 | 33.06 | 35.04 | 3.94 | 46.38 | 74 | -27.62 | Peak | Horizontal |
| 4804.19 | 35.27 | 33.06 | 35.04 | 3.94 | 37.23 | 54 | -16.77 | Average | Horizontal |
| 4804.14 | 47.18 | 33.06 | 35.04 | 3.94 | 49.14 | 74 | -24.86 | Peak | Vertical |
| 4804.20 | 33.61 | 33.06 | 35.04 | 3.94 | 35.57 | 54 | -18.43 | Average | Vertical |

The worst test result for GFSK, Tx-Middle Channel:

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark | Pol. |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4882.21 | 45.67 | 33.16 | 35.15 | 3.96 | 47.64 | 74 | -26.36 | Peak | Horizontal |
| 4882.20 | 37.17 | 33.16 | 35.15 | 3.96 | 39.14 | 54 | -14.86 | Average | Horizontal |
| 4882.14 | 43.96 | 33.16 | 35.15 | 3.96 | 45.93 | 74 | -28.07 | Peak | Vertical |
| 4882.24 | 35.43 | 33.16 | 35.15 | 3.96 | 37.40 | 54 | -16.60 | Average | Vertical |

The worst test result for GFSK, Tx-High Channel:

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab.. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark | Pol. |
|-----------|--------------|----------------|--------------|---------------|-----------------|--------------|-----------|---------|------------|
| 4960.31 | 40.64 | 33.26 | 35.14 | 3.98 | 42.74 | 74 | -31.26 | Peak | Horizontal |
| 4960.38 | 32.80 | 33.26 | 35.14 | 3.98 | 34.90 | 54 | -19.10 | Average | Horizontal |
| 4960.25 | 43.46 | 33.26 | 35.14 | 3.98 | 45.56 | 74 | -28.44 | Peak | Vertical |
| 4960.36 | 35.03 | 33.26 | 35.14 | 3.98 | 37.13 | 54 | -16.87 | Average | Vertical |

Notes:

1. Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30MHz.
2. Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.
3. 18~25GHz at least have 20dB margin. No recording in the test report.

6.7 Results for Band edge Testing (Radiated)

Note: Only recorded the worst test result.

| | | | |
|---------------|--------|-----------|--------------------|
| Temperature | 25°C | Humidity | 60% |
| Test Engineer | Jayden | Test Date | September 18, 2016 |

Tx-2402, GFSK, Non-hopping

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark | Pol. |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2376.39 | 42.68 | 32.89 | 35.16 | 3.51 | 43.92 | 74 | -30.08 | Peak | Horizontal |
| 2376.42 | 31.46 | 32.90 | 35.16 | 3.51 | 32.71 | 54 | -21.29 | Average | Horizontal |
| 2389.97 | 47.97 | 32.92 | 35.16 | 3.54 | 49.27 | 74 | -24.73 | Peak | Horizontal |
| 2389.92 | 37.11 | 32.92 | 35.16 | 3.54 | 38.41 | 54 | -15.59 | Average | Horizontal |
| 2376.48 | 47.49 | 32.89 | 35.16 | 3.51 | 48.73 | 74 | -25.27 | Peak | Vertical |
| 2376.42 | 36.11 | 32.90 | 35.16 | 3.51 | 37.36 | 54 | -16.64 | Average | Vertical |
| 2389.94 | 47.05 | 32.92 | 35.16 | 3.54 | 48.35 | 74 | -25.65 | Peak | Vertical |
| 2390.03 | 34.23 | 32.92 | 35.16 | 3.54 | 35.53 | 54 | -18.47 | Average | Vertical |

Tx-2480, GFSK, Non-hopping

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark | Pol. |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2483.51 | 48.32 | 33.06 | 35.18 | 3.60 | 49.80 | 74 | -24.20 | Peak | Horizontal |
| 2483.50 | 36.64 | 33.08 | 35.18 | 3.60 | 38.14 | 54 | -15.86 | Average | Horizontal |
| 2488.74 | 46.20 | 33.08 | 35.18 | 3.62 | 47.72 | 74 | -26.28 | Peak | Horizontal |
| 2488.76 | 30.28 | 33.08 | 35.18 | 3.62 | 31.80 | 54 | -22.20 | Average | Horizontal |
| 2483.49 | 47.21 | 33.06 | 35.18 | 3.60 | 48.69 | 74 | -25.31 | Peak | Vertical |
| 2483.58 | 36.74 | 33.08 | 35.18 | 3.60 | 38.24 | 54 | -15.76 | Average | Vertical |
| 2488.74 | 47.02 | 33.08 | 35.18 | 3.62 | 48.54 | 74 | -25.46 | Peak | Vertical |
| 2488.79 | 33.00 | 33.08 | 35.18 | 3.62 | 34.52 | 54 | -19.48 | Average | Vertical |

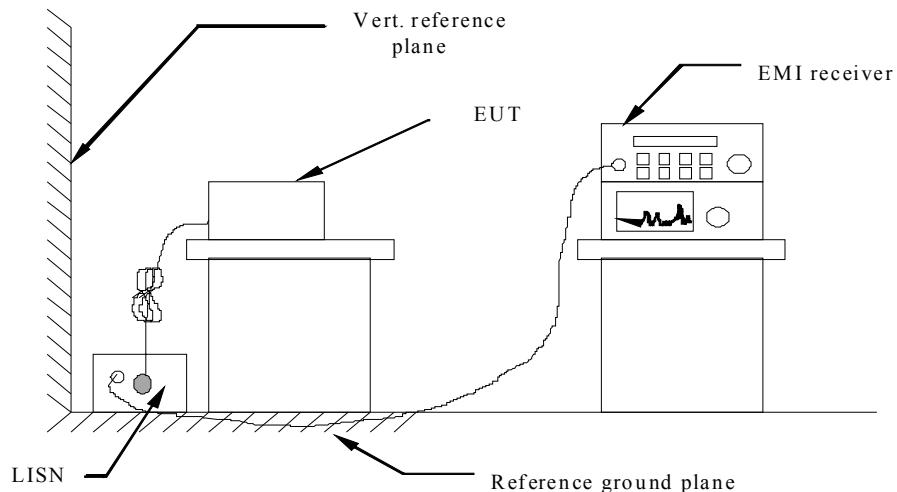
7. POWER LINE CONDUCTED EMISSIONS

7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dB μ V) | |
|-----------------------|---------------------|----------|
| | Quasi-pea k | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

7.2 Block Diagram of Test Setup



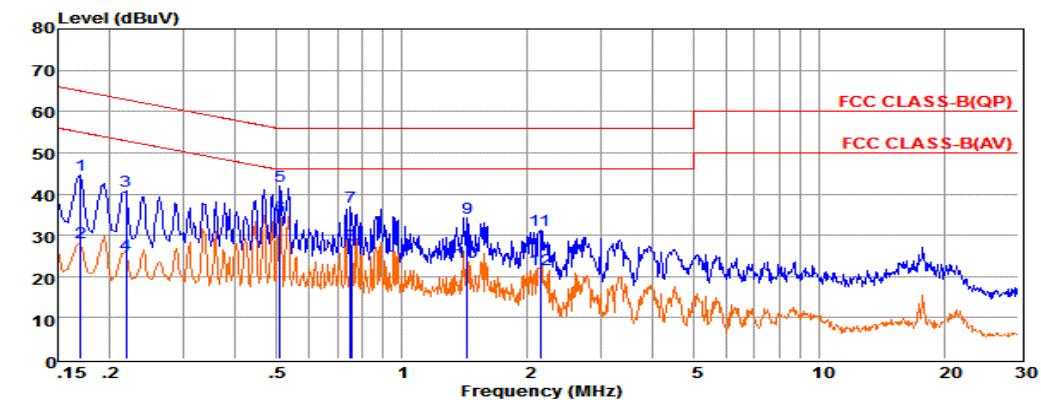
7.3 Test Results

PASS.

The test data please refer to following page.

Note: Only recorded the worst test result.

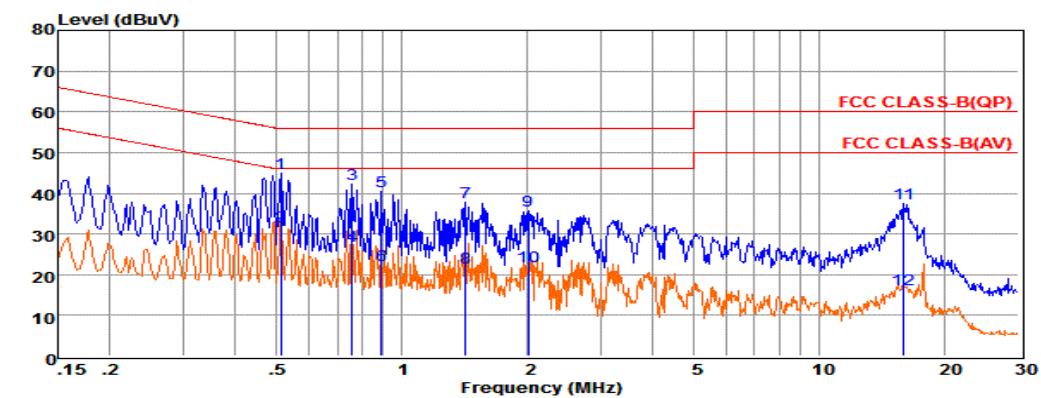
Test result for AC 120V /60Hz



Env. Ins: 24*/56%
 Power Rating: AC 120V/60Hz
 Pol: NEUTRAL

| Freq | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over | Remark |
|------------|---------|---------|--------|-----------|----------|-------|--------|---------|
| MHz | dBuV | dB | dB | dB | dBuV | dBuV | dB | |
| 1 0.17034 | 25.08 | 9.65 | 0.02 | 10.00 | 44.75 | 64.94 | -20.19 | QP |
| 2 0.17044 | 8.54 | 9.65 | 0.02 | 10.00 | 28.21 | 54.94 | -26.73 | Average |
| 3 0.21851 | 20.99 | 9.59 | 0.03 | 10.00 | 40.61 | 62.88 | -22.27 | QP |
| 4 0.21861 | 5.70 | 9.59 | 0.03 | 10.00 | 25.32 | 52.87 | -27.55 | Average |
| 5 0.51007 | 22.22 | 9.62 | 0.04 | 10.00 | 41.88 | 56.00 | -14.12 | QP |
| 6 0.51017 | 14.69 | 9.62 | 0.04 | 10.00 | 34.35 | 46.00 | -11.65 | Average |
| 7 0.75493 | 17.10 | 9.63 | 0.04 | 10.00 | 36.77 | 56.00 | -19.23 | QP |
| 8 0.75503 | 8.06 | 9.63 | 0.04 | 10.00 | 27.73 | 46.00 | -18.27 | Average |
| 9 1.43328 | 14.67 | 9.63 | 0.05 | 10.00 | 34.35 | 56.00 | -21.65 | QP |
| 10 1.43428 | 3.83 | 9.63 | 0.05 | 10.00 | 23.51 | 46.00 | -22.49 | Average |
| 11 2.14392 | 11.68 | 9.63 | 0.05 | 10.00 | 31.36 | 56.00 | -24.64 | QP |
| 12 2.14492 | 2.00 | 9.63 | 0.05 | 10.00 | 21.68 | 46.00 | -24.32 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
 2. The emission levels that are 20dB below the official limit are not reported.

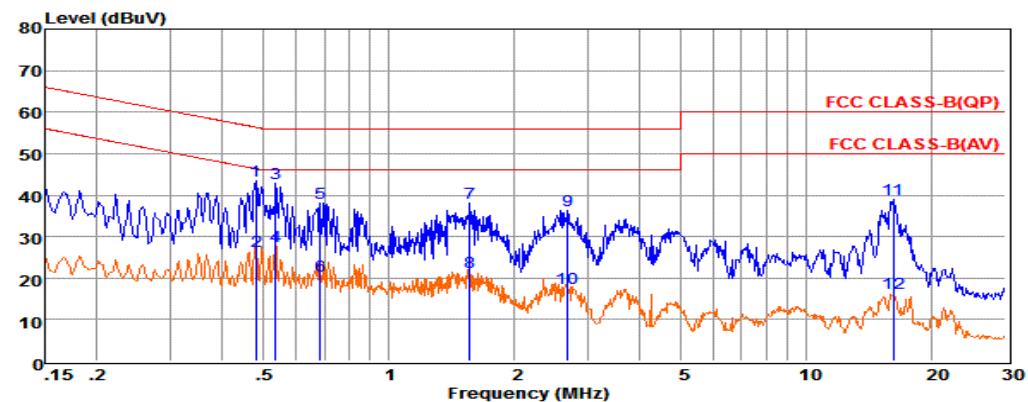


Env. Ins: 24*/56%
 Power Rating: AC 120V/60Hz
 Pol: LINE

| Freq | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over | Remark |
|------------|---------|---------|--------|-----------|----------|-------|--------|---------|
| MHz | dBuV | dB | dB | dB | dBuV | dBuV | dB | |
| 1 0.51278 | 25.21 | 9.62 | 0.04 | 10.00 | 44.87 | 56.00 | -11.13 | QP |
| 2 0.51288 | 12.21 | 9.62 | 0.04 | 10.00 | 31.87 | 46.00 | -14.13 | Average |
| 3 0.75894 | 22.40 | 9.64 | 0.04 | 10.00 | 42.08 | 56.00 | -13.92 | QP |
| 4 0.75904 | 7.24 | 9.64 | 0.04 | 10.00 | 26.92 | 46.00 | -19.08 | Average |
| 5 0.89441 | 20.69 | 9.63 | 0.05 | 10.00 | 40.37 | 56.00 | -15.63 | QP |
| 6 0.89451 | 2.48 | 9.63 | 0.05 | 10.00 | 22.16 | 46.00 | -23.84 | Average |
| 7 1.41817 | 18.20 | 9.64 | 0.05 | 10.00 | 37.89 | 56.00 | -18.11 | QP |
| 8 1.41917 | 1.95 | 9.64 | 0.05 | 10.00 | 21.64 | 46.00 | -24.36 | Average |
| 9 2.01185 | 15.89 | 9.64 | 0.05 | 10.00 | 35.58 | 56.00 | -20.42 | QP |
| 10 2.01285 | 2.28 | 9.64 | 0.05 | 10.00 | 21.97 | 46.00 | -24.03 | Average |
| 1115.96977 | 17.53 | 9.72 | 0.11 | 10.00 | 37.36 | 60.00 | -22.64 | QP |
| 1215.97077 | -3.36 | 9.72 | 0.11 | 10.00 | 16.47 | 50.00 | -33.53 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
 2. The emission levels that are 20dB below the official limit are not reported.

Test result for AC 240V /60Hz



Env. Ins:

24*/56%

Power Rating:

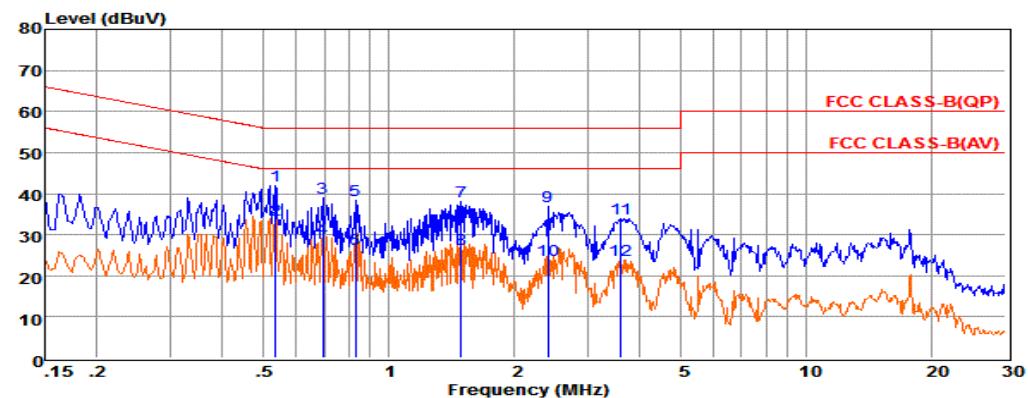
AC 240V/60Hz

Pol:

LINE

| Freq | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over | Remark |
|-------------|---------|---------|--------|-----------|----------|-------|--------|---------|
| MHz | dBuV | dB | dB | dB | dBuV | dBuV | dB | |
| 1 0.48119 | 23.66 | 9.62 | 0.04 | 10.00 | 43.32 | 56.32 | -13.00 | QP |
| 2 0.48129 | 6.90 | 9.62 | 0.04 | 10.00 | 26.56 | 46.32 | -19.76 | Average |
| 3 0.53498 | 23.20 | 9.62 | 0.04 | 10.00 | 42.86 | 56.00 | -13.14 | QP |
| 4 0.53508 | 8.10 | 9.62 | 0.04 | 10.00 | 27.76 | 46.00 | -18.24 | Average |
| 5 0.68626 | 18.40 | 9.64 | 0.04 | 10.00 | 38.08 | 56.00 | -17.92 | QP |
| 6 0.68636 | 0.88 | 9.64 | 0.04 | 10.00 | 20.56 | 46.00 | -25.44 | Average |
| 7 1.56008 | 18.34 | 9.64 | 0.05 | 10.00 | 38.03 | 56.00 | -17.97 | QP |
| 8 1.56108 | 1.81 | 9.64 | 0.05 | 10.00 | 21.50 | 46.00 | -24.50 | Average |
| 9 2.67825 | 16.71 | 9.64 | 0.05 | 10.00 | 36.40 | 56.00 | -19.60 | QP |
| 10 2.67925 | -2.02 | 9.64 | 0.05 | 10.00 | 17.67 | 46.00 | -28.33 | Average |
| 11 16.13990 | 19.24 | 9.72 | 0.11 | 10.00 | 39.07 | 60.00 | -20.93 | QP |
| 12 16.14090 | -3.55 | 9.72 | 0.11 | 10.00 | 16.28 | 50.00 | -33.72 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
 2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins:

24*/56%

Power Rating:

AC 240V/60Hz

Pol:

NEUTRAL

| Freq | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over | Remark |
|------------|---------|---------|--------|-----------|----------|-------|--------|---------|
| MHz | dBuV | dB | dB | dB | dBuV | dBuV | dB | |
| 1 0.53498 | 22.24 | 9.62 | 0.04 | 10.00 | 41.90 | 56.00 | -14.10 | QP |
| 2 0.53508 | 14.08 | 9.62 | 0.04 | 10.00 | 33.74 | 46.00 | -12.26 | Average |
| 3 0.69357 | 19.16 | 9.63 | 0.04 | 10.00 | 38.83 | 56.00 | -17.17 | QP |
| 4 0.69367 | 9.62 | 9.63 | 0.04 | 10.00 | 29.29 | 46.00 | -16.71 | Average |
| 5 0.83047 | 18.75 | 9.63 | 0.04 | 10.00 | 38.42 | 56.00 | -17.58 | QP |
| 6 0.83057 | 6.91 | 9.63 | 0.04 | 10.00 | 26.58 | 46.00 | -19.42 | Average |
| 7 1.48743 | 18.50 | 9.63 | 0.05 | 10.00 | 38.18 | 56.00 | -17.82 | QP |
| 8 1.48843 | 6.84 | 9.63 | 0.05 | 10.00 | 26.52 | 46.00 | -19.48 | Average |
| 9 2.40897 | 17.07 | 9.64 | 0.05 | 10.00 | 36.76 | 56.00 | -19.24 | QP |
| 10 2.40997 | 4.23 | 9.64 | 0.05 | 10.00 | 23.92 | 46.00 | -22.08 | Average |
| 11 3.60337 | 14.24 | 9.65 | 0.06 | 10.00 | 33.95 | 56.00 | -22.05 | QP |
| 12 3.60437 | 4.23 | 9.65 | 0.06 | 10.00 | 23.94 | 46.00 | -22.06 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
 2. The emission levels that are 20dB below the official limit are not reported.

8. ANTENNA REQUIREMENT

8.1 Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

8.2 Antenna Connected Construction

8.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

8.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 0dBi, and the antenna is connected to PCB board and no consideration of replacement. Please see EUT photo for details.

8.2.3. Results: Compliance.

Measurement parameters:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 3 MHz |
| Video bandwidth: | 3 MHz |
| Trace-Mode: | Max hold |

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal Bluetooth devices, the GFSK mode is used.

Limits:

| FCC | IC |
|--------------|----|
| Antenna Gain | |
| 6.0dBi | |

| T _{nom} | V _{nom} | lowest channel 2402 MHz | middle channel 2441 MHz | highest channel 2480 MHz |
|---|------------------|------------------------------------|----------------------------|-----------------------------|
| Conducted power [dBm] Measured with GFSK modulation | | -0.563 | -0.526 | -0.333 |
| Radiated power [dBm] Measured with GFSK modulation | | -0.581 | -0.552 | -0.365 |
| Gain [dBi] Calculated | | -0.018 | 0.026 | 0.032 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3.0 dB (rad.) | | |

Result: -/-

-----THE END OF REPORT-----